Section 3: Transporting Cargo Safely

This section tells you about cargo safety. All drivers must understand some basic cargo safety rules to get a commercial driver's license, because the CDL license allows the driver to transport cargo in a truck.

If you load cargo wrong it can be a danger to others and to yourself. Other highway users can hit or be hit by loose cargo. Your vehicle can be damaged by overload. Steering can be affected badly if you don't load cargo right. Loose cargo can hurt you during a quick stop or crash.

Whether or not you load and secure the cargo yourself, you are responsible for:

- Inspecting your cargo.
- Recognizing overloads and poorly balanced weight.
- Knowing your cargo is securely tied down or covered.

These are discussed below.

If you intend to carry hazardous material that requires placards on your vehicle, you will also have to have a hazardous materials endorsement. Section 7 of this manual has the information you need to pass the hazardous materials test.

This Section Covers

- ***Inspecting Cargo***
- ***Cargo Weight & Balance***
- ***Securing Cargo***
- ***Liquids in Bulk***
- ***Other Cargo Needing Care***

3.1 Inspecting Cargo

As part of your pre-trip inspection, check for overloads, poorly balanced weight, and cargo that is not secured right.

Inspect the cargo and its securing devices again within 25 miles after beginning a trip. Make any adjustments needed. Check the cargo and securing devices as often as necessary during a trip to keep the load secure. Inspect again:

- After you have driven for 3 hours or 150 miles.
- After every break you take during driving.

Federal, state and local regulations of weight, securement, cover, and truck routes vary greatly from place to place. Know the regulations where you will be driving.

- ***Before Starting***
- ***Every 3 hrs / 150 Miles***
- ***After Every Break***

3.2 Weight & Balance

You are responsible for not being overloaded. Here are some definitions of weight you should know:

Gross vehicle weight (GVW). The total weight of a single vehicle plus its load.

Gross combination weight (GCW). The total weight of a powered unit plus trailer(s) plus the cargo.

- ***Definitions You Should Know***

Gross Vehicle Weight Rating (GVWR). The maximum GVW specified by the manufacturer for a single vehicle plus its load.

Gross Combination Weight Rating (GCWR). The maximum GCW specified by the manufacturer for a specific combination of vehicles plus its load.

Axle Weight. The weight transmitted to the ground by one axle or one set of axles.

Tire load. The maximum safe weight a tire can carry at a specified pressure. This rating is stated on the side of each tire.

Suspension systems. Suspension systems have a manufacturer's weight capacity rating.

Coupling device capacity. Coupling devices are rated for the maximum weight they can pull and/or carry.

· *Legal Weight Limits*

You must keep weights within legal limits. States have maximums for GVWs, GCWs and axle weights. Often, maximum axle weights are set by a bridge formula. A bridge formula permits less maximum axle weight for axles that are closer together. This is to prevent overloading bridges and roadways.

Overloading can have bad effects on steering, braking, and speed control. Overloaded trucks have to go very slow on upgrades. Worse, they may gain too much speed on downgrades. Stopping distance increases. Brakes can fail when forced to work too hard.

During bad weather or in mountains, it may not be safe to operate at legal maximum weights. Take this into account before driving.

· *Don't Be Top-Heavy*

The height of the vehicle's center of gravity is very important for safe handling. A high center of gravity (cargo piled up high, or heavy cargo on top) means you are more likely to tip over. It is most dangerous in curves or if you have to swerve to avoid a hazard. It is very important to distribute the cargo so it is as low as possible. Put the heaviest parts of the cargo under the lightest parts.

· *Balance the Weight*

Poor weight balance can make vehicle handling unsafe. Too much weight on the steering axle can cause hard steering. It can damage the steering axle and tires. Underloaded front axles (caused by shifting weight too far to the rear) can make the steering axle weight too light to steer safely. Too little weight on the driving axles can cause poor traction. The drive wheels may spin easily. During bad weather, the truck may not be able to keep going. Weight that is loaded so there is a high center of gravity causes greater chance of rollover. On flat bed vehicles, there is also a greater chance that the load will shift to the side or fall off. Figure 3-1 shows examples of the right and wrong way to balance cargo weight.

Test Your Knowledge

1. For what three things related to cargo are drivers responsible?
2. How often must you stop while on the road to check your cargo?
3. How is **Gross Combination Weight Rating** different from **Gross Combination Weight?**
4. Name two situations where legal maximum weights may not be safe.
5. What can happen if you don't have enough weight on the front axle?

These questions may be on your test. If you can't answer all, reread Sections 3.1 & 3.2.

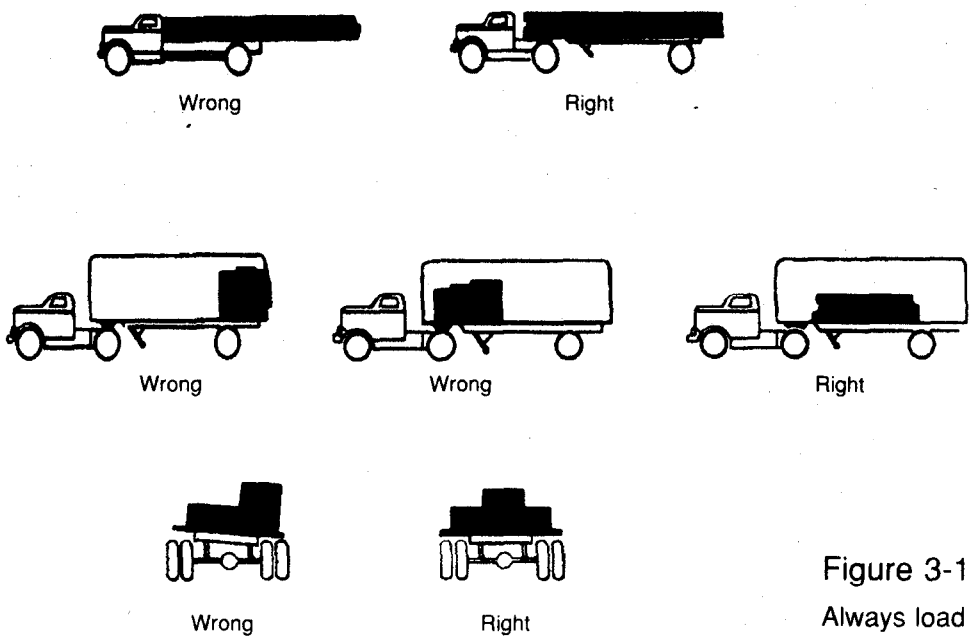

Figure 3-1
Always load cargo the right way!

3.3 Securing Cargo

· ***Blocking and Bracing***

Blocking is used in the front, back, and/or sides of a piece of cargo to keep it from sliding. Blocking is shaped to fit snugly against cargo. It is secured to the cargo deck to prevent cargo movement. **Bracing** is also used to prevent movement of cargo. Bracing goes from the upper part of the cargo to the floor and/or walls of the cargo compartment.

· ***Cargo Tiedown***

On flatbed trailers or trailers without sides, cargo must be secured to keep it from shifting and falling off. In closed vans, tiedowns can also be important to prevent cargo shifting that may affect the handling of the vehicle. Tiedowns must be of the proper type and proper strength. The combined strength of all cargo tiedowns must be strong enough to lift one and one half times the weight of the piece of cargo tied down. Proper tiedown equipment must be used, including ropes, straps, chains, and tensioning devices (winches, ratchets, clinching components). Tiedowns must be attached to the vehicle correctly (hook, bolt, rails, rings).

Cargo should have at least one tiedown for each 10 feet of cargo. Make sure you have enough tiedowns to meet this need. No matter how small the cargo is, it should have at least two tiedowns holding it.

There are special requirements for securing various heavy pieces of metal. Find out what they are if you are to carry such loads.

· ***Header Boards***

Front end header boards ("headache racks") protect you from your cargo in case of a collision. Make sure the front end structure is in good condition. The front end structure should block the forward movement of any cargo you carry.

· ***Covering Cargo***

There are two basic reasons for covering cargo, (1) to protect people from spilled cargo, and (2) to protect the cargo from weather. Spill protection is a safety requirement in many states. Be familiar with the laws in the states you drive in.

You should look at your cargo covers in the mirrors from time to time while driving. A flapping cover can tear loose, uncovering the cargo, and possibly blocking your view or someone else's.

You cannot inspect sealed loads, but you should check that you don't exceed gross weight and axle weight limits.

· ***Sealed & Containerized Loads***

Containerized loads generally are used when freight is carried part way by rail or ship. Delivery by truck occurs at the beginning and/or end of the journey. Some containers have their own tiedown devices or locks that attach directly to a special frame. Others have to be loaded onto flat bed trailers. They are secured with tiedowns just like any other large cargo.

3.4 Tank Vehicles

A "tank vehicle" is a vehicle used to transport any liquid or liquified gaseous material in a permanently attached tank, or a portable tank having a capacity of 1000 gallons or more. Hauling liquids in tanks requires special skills because of high center of gravity and liquid movement.

· ***High Center of Gravity***

High center of gravity means that much of the load's weight is carried high up off the road. This makes the vehicle top-heavy and easy to roll over. Liquid tankers are especially easy to roll over. Tests have shown that **tankers can turn over at the speed limits posted for curves. Take highway curves or on ramp/off ramp curves well below the posted speeds.**

· ***Danger of Surge***

Liquid surge results from movement of the liquid in partially filled tanks. This movement can have bad effects on handling. For example, when coming to a stop, the liquid will surge back and forth. When the wave hits the end of the tank, it tends to push the truck in the direction the wave is moving. If the truck is on a slippery surface such as ice, the wave can shove a stopped truck out into an intersection. The driver of a liquid tanker must be very familiar with the handling of the vehicle.

· ***Bulkheads***

Some liquid tanks are divided into several smaller tanks by bulkheads. When loading and unloading the smaller tanks, the driver must pay attention to weight distribution. Don't put too much weight on the front or rear of the vehicle.

· ***Baffles***

Baffled liquid tanks have bulkheads in them with holes that let the

Test Your Knowledge
1. What is the minimum number of tiedowns for any flat bed load? 2. What is the minimum number of tiedowns for a 20 ft. load? 3. Name the two basic reasons for covering cargo on an open bed. 4. What must you check before transporting a sealed load?
These questions may be on your test. If you can't answer all, reread Section 3.3.

liquid flow through. The baffles help to control the forward and backward liquid surge. However, side to side surge can still occur which can cause a roll over. Be extremely cautious (slow and careful) in taking curves or making sharp turns with a partially or fully loaded liquid tanker.

· ***Smooth Bore Tanks***

Unbaffled liquid tankers (sometimes called "smooth bore" tanks) have nothing inside to slow down the flow of the liquid. Therefore, forward-and-back surge is very strong. Unbaffled tanks are usually those that transport food products (milk, for example). (Sanitation regulations forbid the use of baffles because of the difficulty in cleaning the inside of the tank.) Be extremely cautious (slow and careful) in driving smooth bore tanks, especially when starting and stopping.

· ***Outage***

Outage. Never load a cargo tank totally full. Liquids expand as they warm and you must leave room for the expanding liquid. This is called outage. Since different liquids expand by different amounts, they require different amounts of outage. You must know the outage requirement when hauling liquids in bulk.

· ***Dense Liquids***

A full tank of dense liquid (such as some acids) may exceed legal weight limits. For that reason you may often only partially fill tanks with heavy liquids. The amount of liquid to load into a tank depends on:

- the amount the liquid will expand in transit, and
- the weight of the liquid, and
- legal weight limits.

3.5 Other Cargo Needing Special Attention

· ***Dry Bulk***

Dry bulk tanks require special care because they often have a high center of gravity, and the load can shift. Be extremely cautious (slow and careful) going around curves and making sharp turns.

· ***Hanging Meat***

Hanging meat (suspended beef, pork, lamb) in a refrigerated truck can be a very unstable load with a high center of gravity. Particular caution is needed on sharp curves such as off ramps and on ramps. Go slow.

· ***Livestock***

Livestock can move around in a trailer, causing unsafe handling. With less than a full load, use false bulkheads to keep livestock bunched together. Even when bunched, special care is necessary because livestock can lean on curves. This shifts the center of gravity and makes rollover more likely.

· ***Oversized Loads***

Over length, over width, and/or over weight loads require special transit permits. Driving is usually limited to certain times. Special equipment may be necessary such as "wide load" signs, flashing lights, flags, etc. Such loads may require a police escort or pilot vehicles bearing warning signs and/or flashing lights. These special loads require special driving care.

1. How is a **bulkhead** different from a **baffle**?
2. Should a tanker with liquid take freeway onramps / offramps at the posted speed limit?
3. Are smooth bore tankers different to drive than those with baffles?
4. What three things determine how much liquid you can load?

These questions may be on your test. If you can't answer all, reread Sections 3.4 & 3.5.